

CLAIMS

Having thus described our invention in detail, what we claim as new and desire to secure by the Letters Patent is:

1. A method of fabricating a silicon-on-insulator (SOI) substrate comprising:

providing a structure comprising at least a Si-containing substrate that has a region of vacancies or voids located therein;

implanting oxygen ions into said structure using an oxygen dose of about 1×10^{17} atoms/cm² or less; and

annealing the structure containing implanted oxygen ions and vacancies or voids to form a silicon-on-insulator that includes a Si-containing over-layer and a buried oxide, said buried oxide having a thickness of about 100 nm or less.

2. The method of Claim 1 wherein said Si-containing substrate is a doped substrate containing n- or p-type dopants.

3. The method of Claim 2 wherein said Si-containing substrate is a p-type substrate.

4. The method of Claim 1 wherein said providing step comprises an electrolytic anodization process.

5. The method of Claim 4 wherein said electrolytic anodization process is performed in the presence of a HF-containing solution.

6. The method of Claim 4 wherein the anodization process is performed using a constant current source operating at a current density of from about 0.05 to about 50 milliAmps/cm².

7. The method of Claim 1 wherein said region of vacancies or voids is a porous Si-containing region that has a porosity of about 0.01% or greater.
8. The method of Claim 1 further comprising forming a single crystal Si-containing layer between said providing and said implanting steps.
9. The method of Claim 8 wherein said single crystal Si-containing layer comprises epitaxial Si, amorphous Si, SiGe, single or polycrystalline Si or any combinations thereof.
10. The method of Claim 1 further comprising a bake step between said providing and said implanting steps, with or without subsequent Si-containing layer growth.
11. The method of Claim 10 wherein said bake step is performed in a hydrogen-containing ambient at a temperature from about 800° to about 1200°C.
12. The method of Claim 1 wherein said implanting step is performed at an ion dose from about 1E16 to about 1E17 atoms/cm².
13. The method of Claim 1 wherein said implanting step is performed using a beam current density from about 0.05 to about 500 milliAmps/cm², an energy from about 40 to about 1000 keV, and a temperature from about 200° to about 600° C.
14. The method of Claim 1 wherein said implanting step is a blanket implant process.
15. The method of Claim 1 wherein said implanting step is a patterned implant process.
16. The method of Claim 1 wherein said implanting step further comprises a second oxygen implant step.

17. The method of Claim 16 wherein said second implant step is performed at an oxygen dose from about $1\text{E}14$ to about $1\text{E}16$ atoms/cm² using a beam current density from about 0.05 to about 5 milliAmps/cm², an energy from about 40 to about 1000 keV, and a temperature from about 4K to about 200° C.

18. The method of Claim 1 wherein the annealing is performed in an oxygen-containing ambient.

19. The method of Claim 18 wherein the oxygen-containing ambient further comprises an inert gas.

20. The method of Claim 19 wherein the oxygen-containing ambient is selected from the group consisting of O₂, NO, N₂O, ozone, and air.

21. The method of Claim 1 wherein the annealing is performed at a temperature of from about 650°C to about 1350°C.

22. The method of Claim 1 wherein the annealing forms a surface oxide atop the Si-containing over-layer.

23. A method of fabricating a silicon-on-insulator (SOI) substrate comprising:

providing a structure comprising at least a Si-containing substrate that has a region of vacancies or voids located therein;

forming a single crystal Si-containing layer atop said structure;

implanting oxygen ions into said structure using an oxygen dose of about $1\text{E}17$ atoms/cm² or less; and

annealing the structure containing implanted oxygen ions and vacancies or voids to form a silicon-on-insulator that includes a Si-containing over-layer and a buried oxide, said buried oxide having a thickness of about 100 nm or less.

24. A method of fabricating a silicon-on-insulator (SOI) substrate comprising:

providing a structure comprising at least a Si-containing substrate that has a region of vacancies or voids located therein;

subjecting said structure to a bake step, said bake step is performed in a hydrogen-containing ambient;

implanting oxygen ions into said structure using an oxygen dose of about $1\text{E}17$ atoms/cm² or less; and

annealing the structure containing implanted oxygen ions and vacancies or voids to form a silicon-on-insulator that includes a Si-containing over-layer and a buried oxide, said buried oxide having a thickness of about 100 nm or less.

25. The method of Claim 24 further comprising forming a single crystal Si-containing layer atop said structure, said forming step occurs between said subjecting and said implanting steps.